United States Department of the Interior

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FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

REPLY TO ATTENTION TO

NOV 10 2003

To: Andy Hamilton, Sacramento Fish and Wildlife Office
Roger Guinee, Sacramento Fish and Wildlife Office
Matthew Brown, Red Bluff Fish and Wildlife Office

From: Assistant Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Monitoring of Restoration Projects in Clear Creek Annual Report

Attached for your information is a copy of the fifth annual report for the U.S. Fish and Wildlife Service's Clear Creek Restoration Project Investigations. During the past year, we collected data on the first in-channel portion of the restoration project and modeled the proposed plan for the entire restoration project. In 2004, we plan to complete reports comparing the habitat in the pre-restoration site with both the restoration plan and the first in-channel portion of the restoration project.

If you have any comments or questions about the attached report or our investigations, please feel free to contact Mark Gard at (916) 414-6589.

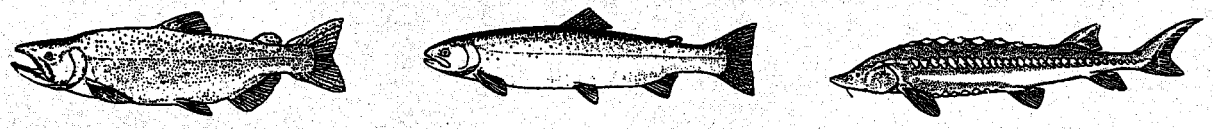
Attachment

MONITORING OF RESTORATION PROJECTS IN CLEAR CREEK, CALIFORNIA

Annual Progress Report
Fiscal Year 2003

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Room W-2605
2800 Cottage Way
Sacramento, CA 95825

Prepared by staff of
The Energy Planning and Instream Flow Branch



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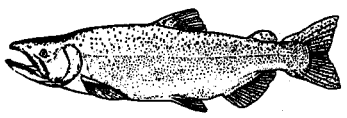

PREFACE

The following is the fifth annual progress report prepared as part of the Clear Creek Restoration Project Monitoring Investigations, a six year effort which began in April 1999[1]. Title 34, section 3406(b)(12) of the Central Valley Project Improvement Act, P.L. 102-575, authorizes funding for channel restoration of Clear Creek to provide spawning, incubation, and rearing habitat for spring and fall-run chinook salmon and steelhead trout. The purpose of this investigation is to evaluate the success of these channel restoration activities.

Written comments or questions about this report or these investigations should be submitted to:

Mark Gard, Senior Fish and Wildlife Biologist
Energy Planning and Instream Flow Branch
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, CA 95821

[1] The length of time for this effort has been extended due to delays in construction of the restoration project.

ACKNOWLEDGMENTS

The field work for this study was conducted by Ed Ballard, Mark Gard, John Kelly, Erin Strange, and Rick Williams. Data analysis and report preparation were performed by Ed Ballard and Mark Gard. Funding was provided by the Central Valley Project Improvement Act.

Introduction

The decline of spring and fall-run chinook salmon and steelhead trout in Clear Creek over the last decade is attributed to many factors including habitat degradation. The existing habitat appears inadequate for both spawning and rearing. The Central Valley Project Improvement Act (CVPIA), section 3406(b)(12), authorizes funding for channel restoration of Clear Creek to provide spawning, incubation, and rearing habitat for salmon and steelhead. In response to this authorization, the U.S. Fish and Wildlife Service (Service) developed the Lower Clear Creek Flood Plain Restoration Project in 1998 to increase spawning success on the section of Clear Creek below Saeltzer Dam. Part of this study proposal included the application of the Service's Instream Flow Incremental Methodology to compare total weighted usable area of salmonid habitat before and after channel restoration using 2-D modeling. The Clear Creek Study was to be a 4-year effort completed in two phases (pre-restoration and post-restoration) by 2005, depending on the schedule of restoration construction. All field work for the pre-restoration evaluation was completed in 1999. The first phase of the in-channel restoration project was completed in the fall of 2002. The post-restoration instream flow study field work on this first phase began in the winter of 2003 and was completed in summer 2003.

Transect Placement (post-restoration study site setup)

Chinook salmon spawning and rearing habitat

The first-phase post-restoration study site was established in January 2003. Two transects were placed in the site, one at the top of the restoration area and one at the bottom.

The bottom transect will be modeled with PHABSIM to provide water surface elevations as an input to the 2-D model. Calibration of the 2-D model will be done using data from the upstream transect. This calibration is accomplished by adjusting the bed roughness until the water surface elevation at the top of the site matches the water surface elevation predicted by PHABSIM. The 2-D model uses as inputs the bed topography, cover, and substrate of a site, and the water surface elevation at the bottom of the site, to predict the amount of habitat present in the site. The 2-D model it is more efficient for modeling juvenile habitat than PHABSIM, since it allows for intensive sampling on the stream margins, where most juvenile habitat is located, and less-intensive sampling in the middle of the river, which tends to have velocities which are too high for juvenile salmon. The 2-D model also has the potential to predict velocities more accurately than PHABSIM, because it uses the bed topography of the entire site, along with conservation of mass and momentum equations to change the distribution of flow across the river at different flows, rather than assuming (as PHABSIM does) that the Manning's n value at a given location does not change with flow.

Transect pins (headpin and tailpins) were marked on each river bank above the 1,000 cfs level using rebar driven into the ground and/or lag bolts placed in tree trunks. Survey flagging and spray paint were used to mark the locations of each pin.

Hydraulic and Structural Data Collection

Chinook salmon spawning and rearing habitat

Hydraulic and structural data collection began in January and was completed in August. Vertical benchmarks were established at the site to serve as the reference elevation to which all elevations (streambed and water surface) were tied. In addition, horizontal benchmarks were established at the site to serve as reference locations to which all horizontal locations (northings and eastings) were tied. Fluvial geomorphologists for the restoration project established total station control points and staff gage locations previous to the start of our IFIM work. Our vertical and horizontal benchmarks were tied into these points.

The data collected on the top and bottom transect include: 1) water surface elevations (WSELs), measured to the nearest 0.01 foot at three different stream discharges using standard surveying techniques (differential leveling); 2) wetted streambed elevations determined by subtracting the measured depth from the surveyed WSEL at a measured flow; 3) dry ground elevations to points above bankfull discharge surveyed to the nearest 0.1 foot; 4) mean water column velocities measured at a high-to-mid range flow at the points where bed elevations were taken; and 5) substrate and cover classification at these same locations and also where dry ground elevations were surveyed. Data collected between the transects include: 1) bed elevation; 2) northing and easting (horizontal location); 3) cover; and 4) substrate. These parameters are collected at enough points to characterize the bed topography, substrate and cover of the entire site.

Water surface elevations were collected at five different flow levels. Discharge measurements have been collected at five different flow levels, while wading with a wading rod equipped with a Marsh-McBirney^{R} model 2000 velocity meter or Price AA velocity meter. The first two measurements were taken in late January. Because of channel changes associated with high flows in April, it is questionable as to whether we will use these measurements.

To validate the velocities predicted by the 2-D model within a site, depth, velocity, substrate and cover measurements were collected throughout the site by wading with a wading rod equipped with a Marsh-McBirney^{R} model 2000 velocity meter or Price AA velocity meter. The horizontal locations and bed elevations were determined by taking a total station shot on a prism held at each point exactly where the velocity and depth were measured. A total of 50 representative points were measured throughout the site.

Hydraulic Model Construction and Calibration

A bed file for the entire restoration reach was developed using the bed topography data for the design of the restoration plan, supplied by the fluvial geomorphologists for the restoration project. A computational mesh was developed and the River 2-D model for the restoration reach was then prepared. Calibration and simulation flow water surface elevations predicted by the pre-restoration site one at the location of the downstream end of the restoration reach (located within the pre-restoration site one) were used for the calibration and simulation flows for the downstream cross-section of the restoration reach. The upstream cross-section of the restoration reach was calibrated using water surface elevations measured at the upstream cross-section of post-restoration site one since the location of this cross-section was at the upper-most end of the restoration project. Production runs for all simulation flows were completed in September 2003. A draft interim report will be prepared by December 2003 evaluating the success of restoration activities in providing more spawning and rearing habitat for salmon, based on the design of the restoration project.

Additional 2-D modeling files will be developed in FY 2004 using the data collected in 2003 on the first in-channel phase of the restoration project, An second interim report will be prepared by May 2004 evaluating the success of restoration activities in providing more spawning and rearing habitat for salmon, based on the 2-D modeling of the first in-channel phase of the restoration project.

Habitat Suitability Criteria (HSC) Development

Habitat Suitability Criteria data will not be collected during this study. HSC previously developed by the Service on the Sacramento River for spawning (FWS 2003) were used to predict the amount of spawning habitat present over a range of discharges in the restoration site prior to and after restoration actions are completed. HSC previously developed by the Service on the Sacramento River for juvenile rearing (report in progress) will be used to predict the amount of spawning and rearing habitat present over a range of discharges in the restoration site prior to and after restoration actions are completed.

Habitat Simulation

Using the same Sacramento River fall-run chinook salmon spawning criteria that were used to compute the spawning habitat for the four pre-restoration study sites in FY 2002, spawning habitat was computed for the entire restoration site in September 2003. Computation of rearing habitat will occur for the four pre-restoration study sites and the entire restoration site in the fall of 2003, and for the first post-restoration site in the winter of 2004.

REFERENCES

U. S. Fish and Wildlife Service 2003. Flow-habitat relationships for steelhead and fall, late-fall and winter-run chinook salmon spawning in the Sacramento River between Keswick Dam and Battle Creek.